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The American Standards Association is organized to provide systematic means of cooperation in establishing American Standards to the end that duplication of work and the promulgation of conflicting standards may be avoided; to serve as a clearing house for information on standardization work in the United States and foreign countries; to act as the authoritative American channel in international cooperation in standardization work

Standardization as Developed in the Lamson & Sessions Company

by

George S. Case, *President*

and

A. E. Buelow, *Chief Engineer*

The Lamson & Sessions Company[1]

Standardization of materials, processes, and products leads to a maximum degree of interchangeability and lowered costs

In 1904 there were two micrometers in the plant of the Lamson & Sessions Company, which then employed about 400 men and manufactured about 3,000,000 bolts and an equal quantity of nuts each week. One of these micrometers had been hand made by a toolmaker for his own use, and the other was in the desk of the superintendent, who did not know how to read it.

Five departmental tool rooms had grown up in the plant, starting with one man and increasing to five or ten. Various classes of dies and tools were made in each of the tool rooms with no general standard. Duplication was possible, and when it did happen, important discrepancies occurred. In some cases, about the only standard was in the eye of the toolmaker.

A thread was used at that time which was more shallow than the United States Standard. The pitch diameter was from 1/64 in. to 1/32 in. more than the United States Standard thread, with an increased flat at the top and bottom.

The practice with cut threads was to make the taps to a hardened gage of no very great accuracy and of no set dimensions. Nuts were tapped and then taken to the cutting machine where the bolts were threaded to fit them. This method usually produced an excellent fit, but of course there was no interchangeability. In many instances the thread was cut on the bolt and the nut was then tapped to fit the bolt.

At about this time the rolled thread was coming into vogue—at first almost entirely on stove bolts and tire bolts, where fits were loose and interchangeability fairly easy. In 1904 it was becoming very common practice to roll larger bolts, and when this was done the thread fit could not be controlled to fit the nuts.

[1] Cleveland, Ohio.

There is a great distance between the methods of manufacture of that day and of the present. The Lamson & Sessions Company, at peak production in 1929, was making 10,000,000 threaded pieces per day, in plants scattered all over the country. Nuts and bolts were all threaded to American Standard limits, and nuts made in one plant were stored in bins sometimes containing millions of pieces; while the bolts to be used with them were frequently made in a plant hundreds of miles away, without any difficulty in maintaining interchangeability. The other details of the bolt, from the dimensions of the head to the exact curve of the point, are covered by standard drawings, so that it is impossible for any one to tell whether a bolt has been made in the plant at Birmingham, Ala., Cleveland, Ohio, or Chicago, Ill.

Standard blueprint sheets on bolt dimensions alone cover 250 sheets and in many cases there are from 50 to 100 dimensions of various sizes of bolts on each sheet. Standard drawings for tools, in order that the tools may be interchangeable between machines in the different plants, cover many more sheets.

In 1904, it would have seemed impossible to manufacture 10,000,000 threaded pieces per day—bolts and nuts counted separately—at plants scattered around the country, and have them all come together without any difficulty as to interchangeability; and, at the same time, have them interchange with the bolts and nuts of every other manufacturer. The men who operated the business in those days would have been horrified at the expense of maintaining the necessary drawings and gages, without realizing that the expense of that maintenance is a small fraction of the expense of the care and supervision over details which was maintained in the earlier years.

Today the Lamson & Sessions Company has five plants which manufacture bolts, screws, nuts, wire

rope clips, and cotter pins. The product varies from a diameter of approximately ⅛ in. to 3 in. and it must be interchangeable. One plant at Kent, Ohio, manufactures nuts only and supplies the other plants and the trade direct. One can readily see the necessity of standardization for this product, due to the fact that the nuts are manufactured entirely independently of the bolts. The product is distributed mainly to general manufacturers, automotive manufacturers, hardware jobbers, and railroads, which are located in all parts of the world.

Beginning of standardization

Lamson & Sessions standardization work dates back to a short time previous to the year 1906 when the first standard blueprints of bolts were made. These prints stated the dimensions of the head, the diameter of the body, and the length of thread, and gave the standard practice as then used in the plant. At that time, each manufacturer had his own size and shape of product and they were subject to frequent change. The program from that time has been to standardize all products wherever possible. This brought about standardization of materials and of the processes required to manufacture the product; for example, tool steels, tools used in the tool department, and heat treatments. In fact, a seed was planted which brought about simplification in the manufacture of the product. Many other standards were started about this time in order to enable the purchasing department intelligently to purchase articles that could be used efficiently in the plant. The five tool rooms and two machine maintenance departments were cut down to one tool room and one maintenance department with a general stock room which handled plant supplies as well as tools.

Standardization of product requires thorough consideration before approval and introduction into the plant. The men approving this work in our organization are the executives of the company, as the work involves membership in outside standardization committees and constant direct contact with sales and manufacture. The sales department must know the product the customer requires, since competition is keen. The sales department cannot approve a standard product which it cannot sell. Many of our executives have served and are now serving on standardization committees of outside organizations. Some of these organizations are as follows: National Screw Thread Commission, American Standards Association, American Society of Mechanical Engineers, Society of Automotive Engineers, American Society for Steel Treating, and Cleveland Engineering Society.

Responsibility for maintenance of all the standards in our organization rests with the engineering department. This department keeps in direct contact with the latest revisions and brings them before the responsible executives for discussion or approval. This gives the executives a chance to discuss them with other manufacturers of the same product and to take up with the various societies the method of procedure for revising present standards.

There are two main types of standards in the organization: product standards, and plant standards. Product standards give specific detailed description of the product we manufacture. Plant standards, adopted by the plant management, give specific detailed description of the means used in the manufacture of the product. Product standards are approved by the executives of the company, and the plant standards are approved by those in charge of the departments concerned.

The American Standards Association has made splendid progress in the development of product standards and they are to be commended for their good work. They have built up a confidence among manufacturers and users which causes the prompt adoption of the American Standards as they are issued.

The work of the National Screw Thread Commission also has aided the bolt and nut industry through the revision of screw thread standards. Previous to the thread standardization, bolts and nuts of different manufacturers, or even of the same manufacturers, were not always interchangeable.

The American Institute of Bolt, Nut and Rivet Manufacturers has done, and is still doing, a considerable amount of work in introducing to manufacturers and users the adopted standards. Today they are a means of bringing many standards to a form in which they can be manufactured efficiently.

Some of the standards which the various societies have been successful in introducing into our manufacturing are:

Standards used in manufacture

Screw threads for bolts, machine screws, nuts and commercially tapped holes
Small rivets
Dimensions of wrench head bolts and nuts and wrench openings
Slotted head proportions, machine screws, cap screws, and wood screws
Track bolts and nuts
Dimensions of round unslotted head bolts
Dimensions of plow bolts
Tinners, coopers and belt rivets

Revisions under consideration at the present time are on:

Dimensions of wrench head bolts and nuts and wrench openings
Stove bolts
Carriage bolts
8-, 12-, and 16-pitch threads

New work at the present time is on:

Tap bolts
Lag screws
Countersunk head bolts
Large rivets
Fitting up bolt threads

Where quantities warrant holding within a standard class of product and there are no national standards, we build up our own product standards. Among the plant standards we have listed and set up are:

Blueprint books stating sizes, types, and dimensions of product with tolerances and limits
Blueprint books stating sizes, types, and dimensions of all tools used in the manufacture of our product, giving tolerances, limits, and other information
Standards on physical and chemical testing
Standard on tool steel materials
Standard sizes of packing boxes, cartons, wrapping paper, string, tape for packing
Standard on ring thread gages and plugs; for measuring thread on product describing type of gage to use for various measurements
Material standard on product materials
Standard wire sizes and blank sizes for product
Standard sizes of emery wheels
Standard nut material sizes
Standard list of supplies and stocks to keep on hand

The aim is to standardize and list everything which comes within plant manufacture. Other standards which apply to the plant and to which we try to conform are:

Tolerances, allowances and gages for metal fits
Tapped, cut and ground threads
Standard diameters and lengths of cold finish shafting
Code for design of transmission shafting
Dimensions of plain taper stock keys, square and flat
National Electrical Safety Code
A.S.M.E. Boiler Code
There are others too numerous to mention.

The engineering department, in design, layout and instructions, follows known standards wherever possible. This means keeping in constant touch with all items on standardization in the various societies and magazines.

Inspection and tests

In order to manufacture to our standards and to other recognized standards, inspection is required. This includes inspection of product during manufacturing, and testing of materials at the receiving point. All material for product is tested to see that it meets specifications submitted with the purchase. Materials are tested by physical and chemical methods. Physical testing requires inspection as to yield point, tensile strength, hardness, bend test, and spark testing. Spark testing has been required on all material before entering stock piles and any question as to the carbon analysis means that there shall be chemical analysis. Physical testing is also done on the finished product. Inspection has to check the product to blueprints during the manufacture and continue to do so during and after plant operations. All product receives a final inspection before shipment to insure its meeting specifications. The purchasing department purchases to specifications on items that are standardized. The purchasing and engineering departments must cooperate to obtain the best material for the work at a minimum cost.

There are approximately 100 blueprint books to keep revised in the five present plants and offices. One part of the engineering department deals entirely with sales and devotes its entire time to placing the customer's inquiries and orders in a standardized form. This avoids many errors in the sales and cost departments both in quoting to the customer and in entering the order for plant manufacture. Standard product is not accompanied by a blueprint but is made to the standard blueprint book which is in each department. Special work is always accompanied by a blueprint upon which all necessary information for manufacturing is detailed. Drawings of the bolt are always outlined to a standard form so that a certain dimension will always be found in the same place.

Each standard product has a certain key number which will be its blueprint number if it is detailed. Special blueprints also have their key numbers which are derived from the standard number; for example, No. 40-72-756. This number means that the head is a square head machine bolt, which is No. 40; the diameter of the bolt is 72/64 or 1⅛ in.; the length of the bolt is 256/16 or 16 in. from which we get the number 256, and the five added to the two, making the number 756, means that there will be extra

operations. Therefore, the number in itself, 40-72-756, means 1⅛ x 16 in. Special Machine Bolt. This type of classification is used on all plant work for the cost department, so that sufficient description to locate the price can be punched on the cards of Powers accounting machines.

Research work carried out in connection with the standardization program is divided into two divisions. The first includes research under the direction of the research metallurgist; the second includes design and building of new machines for production.

These divisions have made great strides toward standardizing production and simplifying processes. Both are directly under the supervision of the general manager of plants. Research has led to the standardizing of tools, tool steels, and methods. At present we can supply 75 per cent of the tools for all plants from one tool-making department. The research departments are continually devoting their time to plant standardization problems due to the fact that simplification leads to new developments and is the main function of standardization.

Standard machines used

Ninety per cent of the machines used in manufacturing bolts and nuts are standard machines manufactured by outside sources. Wherever possible our own designs incorporate standardized machine designs, and we consider the purchase of parts only from standardized manufacturers. This allows replacement of parts at lower costs and quicker delivery. Where present parts are to be repaired on machinery, and where the cost would be too great to replace with new parts, the old parts are maintained until safety becomes a factor, when the part is entirely replaced. The replaced part is again of the original size. Limits and tolerances are specified and the American Standards on tolerances, allowances, and gages for metal fits act as a guide.

Our product limits and tolerances must be considered in the manufacture of the product in order to obtain interchangeability. For this purpose thread Go and Not Go gages, pitch micrometers, supermicrometers, snap gages, comparators, toolmakers' micrometers, measurement gages and master gages are required. The gages must be checked and replaced continually. Checking and replacement of gages is under the supervision of the chief inspector. This permits interchangeability of product in our various plants and, at the same time, allows standardized processes throughout the plants.

The final standards, as stated previously, are those of the American Standards Association, except where our own standards are used.

Tolerances and limits must be held on the tools to obtain standardized product and this has led to the standardization not only of the section of the tool in which the product is formed but also of the general dimensions of the tools, in order to permit interchangeability of the tools in the machines. To make tools and allow for interchangeability in five plants, means an increase in the number of a size which can be made in one run, and this means decidedly lower costs. Even special forms can be made rapidly from standard blanks where standardized blanks are stocked. Tool inserts have also been standardized so that tool steel consumption is reduced, tool labor decreased, and production increased.

Standardization has bettered the quality of the product; it has decreased the amount of plant labor; and it has hastened the service to the customer; thereby assuring more orders with a lower cost and bringing about savings both to the consumer and the manufacturer. Under present day conditions, the manufacturer cannot compete unless he has standardization of the product he manufactures and also standardization in manufacturing; because success in obtaining orders depends entirely upon quality, price, and delivery. Standardization in the plant permits estimating the work to be done. The product which goes to the hardware jobbers is chiefly standard but most of the product shipped to general manufacturers, railroads, and automotive industries is special in some way.

Standardization permits a minimum inventory of finished product ready for delivery. Orders which are placed for stock inventory can be made in such a quantity as the plant can manufacture economically and efficiently. The process has been standardized so as to produce quickly. Conditions in the last two years, and especially at the present time, have brought to our attention the fact that we must manufacture a product faster, in smaller lots, and at less cost than in 1929. Inventories of raw material can be kept at a minimum because the supply source can maintain a stock of standard material. Where deliveries of two weeks or more were formerly required on raw materials they can now be obtained under normal conditions from immediate stock. At present we are proceeding with the standardization of a supply stock room for three plants. The inventory of supplies will be reduced approximately 50 per cent and these plants supplied with better and more complete service than in the past. Minimum inventories demand standardized manufacturing and since modern plant management demands minimum inventories the manufacturer must cooperate in maintaining standardized methods.

When changes in standards are necessary, or when

new standards are introduced which may make changes at some points, it is very necessary to have the work carefully planned or the cost will be prohibitive. If this work is so planned as to allow working off of old stocks and old dies, with the smaller inventories which standards frequently allow, it is usually found that there is an immediate saving.

Our general manager, Mr. R. H. Smith, continually makes the statement that "Work well planned, with the best of thought, means the success of that problem." In fact, many projects that were put into operation and failed would never have been put into operation if they had been well planned.

Other phases of standardization

Yearly plant expenditures for construction work must be estimated and made at the beginning of each year. This involves careful planning so that these expenditures can be financed during the year. The amount can be set but changes in procedure of these expenditures can be adjusted every three or six months. This places before the management the important construction problems for the year and allows a definite program to be followed. This phase of the work can be called "standardized plant construction problems," and enters into the general standardization program of the organization.

Even the matter of employment and management of personnel is standardized to a very high degree. The employment department supervises all of the plants and gives consideration to the health, medical attention, fairness of treatment, and to the placing of employees in the work at which they will be most happy and efficient. During the present period, when many employees are working on very short time or are laid off entirely, the standard records and methods of this department have been of great value in handling the many difficult individual situations.

A very valuable form of standardization has been that of the measurement of the efficiency of the utilization of labor by the time-study method. Careful study of each job results in increased output and earnings for the employees, with the satisfaction which comes from rates of pay set so as to be fair to all concerned.

Many difficulties have been solved through standardization and its advantages have been especially shown during the last two years. Where a number of plants are to be considered, central divisions of supervision, research, engineering, tool making, stock supplies, etc., tend to decrease organization overhead. Difficulties must be met as they arise but many difficulties can be caught beforehand by well planned procedure, and this is standardization.

British Railways Save Through Standardization

The savings being made by British railways through standardization are being featured prominently in the British press. According to *Engineering*, London, the Southern Railway Company has succeeded by means of standardization in making drastic reductions in the number of items carried in stock. Types of bolts, nuts, and rivets stored were reduced in number from 4,317 to 1,105, a decrease of 74 per cent. Bricks and earthenware pipe items were reduced from 640 to 51, or 92 per cent. The number of types of electrical fittings was reduced from 3,109 to 720, 77 per cent; gas and water fittings from 2,741 to 330, or 88 per cent; implements and tools from 2,078 to 592, or 72 per cent; nails, screws, and cotter pins from 2,677 to 900, or 66 per cent.

Chemical Age, London, tells of the advantages derived by the London, Midland, and Scottish Railway Company through standardization resulting from the operations of the railway's Scientific Research Committee. The number of items purchased by the company was reduced about 35 per cent. Such an item as the felt pads under railway chairs had previously been purchased in hundreds of patterns. Following standardization the number was reduced to 45. Eight types of varnishes replaced 28. The number of types of firing shovels was reduced from 9 to 2. Nine different kinds of soap are now used in place of 25. Coincident with the reduction in classes of paints from 130 to 55, one type of paint costing 2 shillings has successfully replaced another costing 10 shillings per pound.

British Chemical Industry Wants Standardization

Within recent months the scope of the old British Engineering Standards Association has been widened, and the new British Standards Institution embraces a comprehensive field in which provision is made for every important branch of engineering activity. Outstanding among its new activities has been the establishment of the Chemical Division, which aims at the standardization not only of chemical materials but of the plant and engineering requirements of the chemical industry. Sufficient has already appeared in the columns of the *Chemical Age* to show that the motive underlying standardization practice is not the mere introduction of rules and formulae, but the modelling of sound general prin-

ciples which will make for the increased efficiency of industry.

This tendency affords evidence of the recognition of the need for cooperation and coordination in one of the most vital industries of the nation, and demonstrates that the makers of plant as well as the chemical manufacturers are willing and anxious to avail themselves of every opportunity for improvement. As the president of the Board of Trade said last week, the standards movement is of more than national importance. . . . Inter-imperial cooperation tends to confer ever-increasing benefits upon the countries concerned, and we commend the participation of the chemical industry in the movement as one of the most hopeful signs for the future.—*"Chemical Age", London.*

Burt Member of ASA Board of Directors

Clayton R. Burt, president and general manager of the Pratt and Whitney Company, Hartford, Connecticut, has been elected as a member of the Board of Directors of the American Standards Association, representing the National Machine Tool Builders' Association.

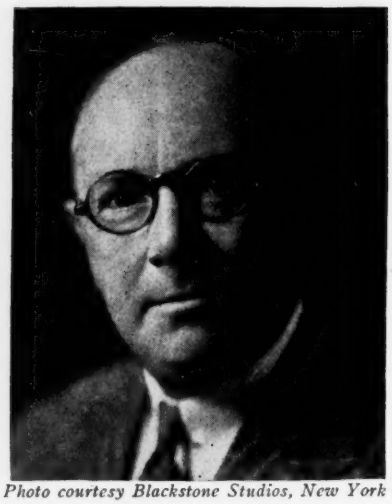

Photo courtesy Blackstone Studios, New York

Clayton R. Burt

Mr. Burt has had a wide and varied experience in manufacturing lines. He received his early training at the plant of the Brown & Sharpe Manufacturing Company of Providence, R. I. During the World War he was responsible for the equipping and the successful operation of four large manufacturing plants in Toronto and two in Buffalo, employing 12,000 operators producing shells, fuses, and gun mounts. In recognition of the record made in these shops Mr. Burt received special mention from the British Government and from the United States Navy at Washington.

After the war, Mr. Burt became president of the New Process Gear Company of Syracuse, New York, connected with the Willys Corporation, and later he was president of the Austin Machinery Company of Toledo, Ohio.

Mr. Burt is a member of the Board of Directors of the National Machine Tool Builders' Association.

Standard Holes Would Cut Drilling Tool Costs

Savings up to 50 per cent of the total cost of drilling tools can be made by California oil producing companies by standardizing the size hole to be drilled through each size casing, according to Brad Mills, writing in the May 23, 1932, issue of the *Oil Weekly*. The American Petroleum Institute is now investigating this problem with a view to preparing standards if it is found feasible.

"During the past year," Mr. Mills states, "84 sizes of drilling bits have been manufactured and used in California fields. Four sizes of bits were used to drill through one large size casing, where it would have been possible to use only one size bit. The same multiplicity of sizes applied to reamers and core barrels.

"When the number of tools used is multiplied by the number of sizes, and this product is multiplied by the number of wells drilled in a given period, it is easy to see what the average tool manufacturer faces.

"Both the manufacturers and producing companies lose because of a lack of standardization. If the former is to remain in business, he must pass his losses on to the oil companies. If the latter is to force an improvement, he will agree to use a limited number of sizes under average conditions.

"The oil companies are responsible for the multiplicity of sizes. They have made a study of conditions, and demand certain sizes to meet their best arguments. The arguments one company advances for a certain size hole to be drilled through a casing of given size are often very nearly the same arguments which another company offers for drilling a slightly smaller or larger hole.

"This situation suggests that it should be pos-

sible to standardize on not more than two sizes of drilling tools for each casing size, and in the larger sizes it should be an easy matter to agree on only one size of hole to be drilled."

Federal Specifications Available for Purchase

The following Federal Specifications have recently been published and copies may be purchased from the Government Printing Office, Washington, D. C., or may be borrowed or purchased through the office of the American Standards Association:

Brass, commercial; bars, plates, rods, shapes, sheets, and strips
Copper; bars, plates, rods, shapes, sheets, and strips
Ferrochromium
Ferrotitanium
Glass; flat, glazing (for) transmitting not less than 25 per cent of ultra-violet radiation at wave length 302 millimicrons
Hose; chemical
Hose; water, braided
Iron, malleable; castings
Iron; pig, foundry
Manganese; ore
Metal, antifriction; castings and ingots
Packing; asbestos, sheet, compressed
Paper; drawing
Paper specifications
Paper; tracing
Rods; welding, nonferrous (for) gas welding
Rope; cotton
Scales; railroad-track
Steel; castings
Steel; plates (marine boiler)
Steel; structural (including steel for cold flanging), and steel, rivet (for) ships other than naval vessels
Stone; architectural, cast
Valves; rubber
Varnish; spar, water-resisting

A.S.T.M. Publication on Refractories

The American Society for Testing Materials has recently issued a publication which brings together in convenient form the several A.S.T.M. standard specifications, methods of test, and definitions pertaining to refractories; and which also includes the latest revision of the Manual for Interpretation of Refractory Test Data.

The standard specifications given in the publication cover clay fire brick for malleable furnaces and for stationary and marine boiler service. The methods of test cover refractory brick; refractory materials under load at high temperatures; porosity and permanent volume changes in refractory materials; softening point of fire-clay brick; and complete chemical analysis of refractory materials. Tentative test methods for resistance of fire-clay brick to thermal spalling and for determining the particle size of ground refractory materials are also included in the publication, as well as definitions for clay refractories, and for terms relating to refractories and heat transmission of refractory materials.

To promote the use of refractory tests in the control of manufacture, inspection, and utilization or refractories, A.S.T.M. Committee C-8 has prepared the Manual for Interpretation of Refractory Test Data. The manual discusses important phases of this subject and puts test procedure and methods for reporting data on a sound statistical basis.

Copies of the publication are available at 50 cents each from the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. Copies may also be purchased, or borrowed for review, from the American Standards Association.

Holland to Participate in International Work on Petroleum

In March, 1932, a discussion took place between the national standardizing body in Holland (Central Normalisatie Bureau) and petroleum interests in that country on the standardization of nomenclature and methods of test of petroleum products. In this discussion reference was made to the fact that the subject has been taken up internationally under the auspices of the International Standards Association, the American Standards Association being entrusted with the secretariat for this work. In the conference of the Dutch body it was stated that considerable work, both national and international, has been done for the technical rating of mineral oils, but that so far there has been a lack of cooperation and uniformity in the results. There was a unanimous opinion that a Dutch committee should be organized in order to participate systematically in the international work now being done by the ISA committee on Nomenclature and Methods of Test of Petroleum Products.

Publication on Municipal Purchasing Cites Need for Standardization

Another in the valuable series of phamphlets on governmental purchasing has been issued by the Municipal Administration Service, 261 Broadway, New York. The present pamphlet, *Purchasing for Small Cities,* was prepared by Russell Forbes, secretary of the National Municipal League, who was also the author of the previous publications. The pamphlet outlines methods of organization of centralized purchasing for cities with less than 25,000 population. The price of the pamphlet is 25 cents.

An introduction by Walter N. Copeland, purchasing agent for Maryland, states that centralized purchasing competently administered has been proved to save 10 per cent on expenditures.

The pamphlet contains sections on a purchasing staff, cost of purchasing, requisitioning matériel, standardization, purchase negotiation, awarding the order or contract, emergency orders, inspecting and testing deliveries, storage and stock control, approval of invoices. The section on standardization will be of interest to industrial organizations as well as to municipalities. This section is reprinted below, through the courtesy of the Municipal Administration Service.

"Some degree of standardization is necessary in every city, regardless of its size, if the system of centralized purchasing is to realize the expected economies. In the absence of standardization, centralized purchasing will result merely in the concentration in one office of all orders and contracts which were formerly awarded through several offices. Without the adoption of the minimum number of standards and their description in the form of written specifications, it is impossible to consolidate requisitions from the different using branches into large orders and contracts and thereby to reduce unit costs through bulk buying. Without such consolidation of requisitions, the gross number of orders and invoices and the amount of paper work will not be lessened.

"All supplies, materials, and equipment used in a city of less than 25,000 population are of course not subject to standardization. It would be a waste of time and energy and a fruitless search for economy to attempt the formulation of written specifications for those articles which are consumed in minute quantities or are used by only a few of the operating departments. But even a small city buys in rather large quantities certain articles which are common to the needs of all or a majority of the using branches; for example, coal, gasoline, lubricating oil, stationery, furniture, textiles, foodstuffs and groceries, water pipe, office equipment, electric fixtures, and automotive equipment. For these and other staple commodities the city should reduce its shopping list to the minimum number of sizes, types, and qualities which are consistent with the successful operation of the various departments. Otherwise, each operating department will continue to demand its particular choice of a given commodity and the purchasing office will place a large number of small orders for retail lots at retail prices.

"Few, if any, purchasing officials are qualified, however, to assume full responsibility for adopting standards and preparing written specifications. Standardization should be a joint enterprise in which all interested parties—the purchasing agent, the chief executive, the using branches, the city engineer, and the chemist—should participate on a coordinate basis. Great care should be exercised to adopt these standards of quality and performance which will suit the requirements of the majority of the users. Quality and performance should be considered of equal importance with price in determining the best commodity to purchase. The specifications should be sufficiently elastic to include articles that are regularly manufactured and sold by a number of dealers so that the maximum competition can be secured. The specification should also be as nontechnical as possible so that it can be understood by the operating department of the city, by the purchasing official, and by the competing vendors. An over-technical specification discourages competition and also increases the difficulty of inspecting the delivery to insure its compliance with the terms of the order.

"In small cities with the manager plan of government, the manager, acting as purchasing official, should assume the leadership in the standardization program, but should make use of the engineers and chemists in the operating departments for expert advice on the city's requirements. When the city engineer acts also as purchasing agent, as in Olympia, Washington, or when the city manager is himself an engineer, the work of standardization is greatly facilitated.

"Fortunately, all small cities can make use of the standard specifications adopted by the states and by the federal government and thus spare themselves the pain of preparation *de novo*. Most state governments have prepared specifications for highway materials, and equipment which can quite easily be modified to meet the precise requirements of cities. The Federal Specifications Board has prepared and adopted for federal use hundreds of standard specifications which, with slight changes, can be adopted as municipal standards. Practically all the purchasing offices in small cities whose methods have been examined in this study have taken over as many state and federal specifications as are applicable to their own needs.

"No city purchasing official should fail to make use of the valuable aids to standardization that are available without charge from the Bureau of Standards, Washington, D. C. The Bureau will send upon application a copy of Bureau of Standards Circular 319 giving an up-to-date list of federal specifications, most of which can be secured free or for the nominal cost of printing. In 1925 the federal government published the *National Directory of Commodity Specifications*, which includes a classified list of all standard specifications adopted by the federal government and other standardizing bodies on any given commodity and indicates the source from which they may be obtained.[1] To facilitate the use of federal specifications, the Bureau of Standards has compiled lists of manufacturers who are 'willing to certify' that their products comply with the given federal specification and that such products will be labeled accordingly. By the use of this material, the purchasing official is furnished with a ready-made supply list as a basis for stimulating competition."[2]

Use of Standards Most Important

The following editorial is reprinted from the December, 1931, issue of "Machinery":

We recently came across the quotation "It isn't enough to convince a man that you are right; you must get him to act on his conviction."

This quotation applies to much of the work done by engineering and trade associations. Conventions are held, able speakers advocate commendable lines of action, and the members applaud the speakers, and are thoroughly convinced that they are right. It is generally agreed that it would be valuable both to individual companies and to industry as a whole to follow the suggestions made. Yet, beyond the applause, no definite action follows.

Somewhat similar conditions may be observed with reference to standardization work. Engineers labor hard to develop standards acceptable to industry. The standards are approved by the final authority in each case, whether it be the board of an association, a society as a whole, or the American Standards Association, which has the final say in national standardization projects. But after the standard has been approved, very little is done to promote its application in industry at large. The standardization committee has finished its work; and whether or not the standard is generally accepted depends largely upon the action of individual engineers throughout industry.

Perhaps the most important work in connection with standardization is not the formal acceptance of a standard by an association, but the work that follows the acceptance—that is, the steps taken to induce industry to make use of the standard.

[1] The 1932 edition of the *National Directory of Commodity Specifications* can now be obtained from the Superintendent of Documents, Government Printing Office, for $1.75 per copy, or through the American Standards Association.

[2] These lists, and the other publications described above, can be secured from A. S. McAllister, chief, Division of Specifications, Bureau of Standards, Washington, D. C.

Needed—A Safety Code for Walkway Surfaces

The following editorial is reprinted from "Maintenance Engineering," April, 1932:

Slippery or uneven walkways often look innocent enough, yet they present one of the greatest hazards to human life in industry. According to the U. S. Bureau of Vital Statistics, the annual number of deaths in this country in late years from falls is over 17,000. It is estimated that a large part of these fatalities are caused by slipping and tripping on walkways—stairs, floors, runways, and streets.

Engineers and architects in close touch with the problem are in agreement that, if all walkways were constructed and maintained according to specific standards of safety, many of these lives could be saved. Such an objective requires a definite standard or yardstick for determining whether each walkway surface is hazardous or safe—in short, a safety code for walkways is urgently needed.

Commendable progress has been made toward the formulation of such a code. In 1923 a sectional committee, organized by the American Standards Association and sponsored by the American Society

of Safety Engineers and the American Institute of Architects, started to work on the problem. Later, a committee of manufacturers and distributors of walkway materials was formed, through which a research fellowship at the National Bureau of Standards in Washington was instituted to determine the frictional resistances for various walkway surface materials. Outgrowth of this fellowship is Research Paper No. 204 of the National Bureau of Standards entitled *A Method of Measuring Frictional Co-efficients of Walkway Surfaces.*

Although this paper is a step in the right direction, there is considerable work yet to be done. What is needed is a finished code enacted into a law that specifies the minimum coefficients of friction required for each walkway surface in designated locations and under all possible conditions. Because maintenance engineers are directly concerned with safety they can be depended upon to lend enthusiastic support to the speedy formulation and enactment of such a code.

Standard Paper Sizes Widely Used in Germany

The system of standard paper sizes originated by Dr. Porstmann, which was described in the July issue (p. 201), has been widely adopted in Germany by governmental bodies, the federal railways, and a large number of municipalities and business concerns in general. In order to promote its adoption still more widely, a label as shown in Figure 1, to be pasted on letters and printed matter, has been worked out by the German national standardizing body (Deutscher Normenausschuss). Two and a half millions of these labels are being distributed. The text of the label states that the standard sizes have been adopted both as governmental and business sizes. The central part of the label contains an exhortation to use standard sizes, as these make for orderliness in correspondence. The three most commonly used sizes are given in the left-hand lower corner. These are the size A4 for standard letterhead; the size C6 for the envelope to go with the standard letterhead; and the size A6 for the standard postcard. Incidentally, the use of the latter is permissible also in international correspondence, as agreed some years ago by the International Postal Union of which the United States is a member.

FIG. 1

Label urging use of standard sizes

Seek Loose-Leaf Standards

How the lack of standardization can affect the sales of a product is shown in an article published in a recent issue of the *British and Colonial Printer and Stationer*, London. The writer of the article calls attention to the relatively small market for loose-leaf binders in England. In this connection he says:

> "While I do not propose to point out the advantages or disadvantages of standardization, I do most seriously suggest if it were adopted it would benefit both the manufacturers and the users.
>
> "Many people, I feel convinced, who are at present dubious of installing loose-leaf are held back by the knowledge that they have usually to purchase their sheets from the manufacturer of the ledger. If, however, such could purchase any of the stock rulings in packets of 100 or 250 from any well-known stationer, with the knowledge that the size and gauge were correct, and that the sheets would fit their binder, the popularity of the loose-leaf system would be much more appreciated by the ordinary individual and would prove an advantage to the manufacturers by the increased sales."

Simplified Practice Recommendation on Forged Tools

Simplified Practice Recommendation R17-31 on forged tools, which has been instrumental in reducing the number of forged tools from 665 to 431 —35 per cent—and their eye sizes from 120 to 10— 91.6 per cent, has been reaffirmed, without change, by the standing committee of the industry, according to an announcement by the Division of Simplified Practice of the National Bureau of Standards.

ASA PROJECTS

Report on Proposed American Standard for Electrical Definitions

by
H. E. Farrer,[1] *Secretary*
Sectional Committee on Definitions
of Electrical Terms[2]

For a period of over three years a committee has been at work on the compilation of a report on proposed American Standard electrical definitions. This project had its inception in 1928 in the recommendation of the American Institute of Electrical Engineers Standards Committee. It has been carried forward in full accordance with the rules of procedure of the American Standards Association and the sponsorship of the A.I.E.E., and the first complete report of the committee, consisting of 208 pages and listing over 3,000 definitions, is now available in pamphlet form.

To those who have been closely in touch with the development of standards in the electrical field it has been evident for many years that a centralization of the agencies responsible for the formulation of electrical definitions was greatly needed. A coordination of the existing definitions was just as essential. In many cases a number of synonymous terms are in use where but one term would be far more desirable; in other cases, the same term has been defined in several ways, although the application in each case is identical. The attempted clearing up of such conditions, together with the collation of the existing definitions deemed desirable of inclusion in their report, have been the two principal items before the sectional committee over three years of continuous work.

Following the formulation of the official scope of the project—"definitions of technical terms used in electrical engineering, including correlation of definitions and terms in existing standards"—a preliminary survey was made and it was decided to divide the field into 17 subgroups in order that the work might dovetail into a logical scheme already in use internationally by the Secretariat on Nomenclature of the International Electrotechnical Commission. The personnel of these 17 subcommittees together with that of the main sectional committee, totalled about 120. The additional expert help sought by many of the subgroups brought the total number cooperating to over 300. Where active sectional committees existed whose scope corresponded closely with any of the subdivisions of the definitions field determined upon, their close cooperation was obtained, even to the extent in certain instances of their acting as the subcommittee itself.

In order that every opportunity might be given for comment and criticism, the individual reports of the subcommittees were widely circulated in each of their several stages of development. Controversies on proper wording naturally developed in many instances. In most cases the subcommittees have been able to arrive at an acceptable solution within their own groups. In cases of overlapping fields, the executive committee under the able guidance of Chairman A. E. Kennelly was called into action. Even after the most earnest efforts to eliminate conflicting definitions, it will be noted that certain conflicts still exist. It was felt to be very desirable, however, to issue the report as it now stands with the hope that circulation in pamphlet form would result not only in obtaining further suggestions of a helpful nature, but also that it might lead, perhaps, to a solution of the questions still unsettled.

With reference to the cases where there existed conflicting definitions of identical terms, all having the status of American Standards, the sectional committee on electrical definitions has selected what appeared to it to be the best wording. In other cases it has been felt desirable to suggest for a term or concept a wording differing from an accepted standard. The object in view always has been the development for each term of the expression of meaning generally associated with it in electrical engineering in this country. When possible, definitions have been generalized so as not to preclude the different specific interpretations attached to particular applications. A reference to the extensive alphabetical index accom-

[1] Secretary of the Standards Committee of the American Institute of Electrical Engineers.

[2] ASA project C42.

panying the report will serve not only as a means of readily indicating whether a term has been defined, but also will show the instances where it has more than one application and where conflicting wordings are still existent.

In order that a very general picture may be had of the extent and manner in which the field was covered, a listing of the general subdivisions follows: general (fundamental and derived) terms; rotating machinery; transformers, regulators, reactors and rectifiers; switching equipment (report not available as yet); control equipment; instruments, meters and meter testing; generation, transmission and distribution; transportation; electromechanical applications; welding and cutting; illuminating; electrochemistry and electrometallurgy; wire communication; radio communication; radiology; electrobiology including therapeutics; miscellaneous.

One particular point of interest is the inclusion under the first group on "general terms" of a subdivision "laws and effects". It was the general feeling that this compilation of the accepted statements of laws and effects would add greatly to the value of the committee's work, providing a ready reference to material which would otherwise require search through many volumes of a technical library.

The sectional committee wishes to express its sincere appreciation of the spirit of cooperation which it has met on all sides, and acknowledges its indebtedness to all organizations and individuals who have given so freely of their time and experience. The assistance obtained from glossaries issued by various technical organizations, particularly the British, and the experience of the Secretariat on Nomenclature of the International Electrotechnical Commission, have been particularly helpful.

The glossary in its present state is incomplete, but it is impractical to carry through the entire program at one time. The cost involved to date has been great; therefore, it has been found necessary to make a nominal charge for copies of the report. This price has been set at one dollar per copy. The report may be purchased from the American Institute of Electrical Engineers or from ASA.

All comments and suggestions relative to the definitions should be addressed to the American Institute of Electrical Engineers, 33 West 39 Street, New York.

ASA Approves Standards for Copper Wire Bars

As the result of a recent action by the ASA Standards Council, the following two specifications for copper wire bars have been added to the list of American Standards:

Standard Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (H17.1-1932)
Standard Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (H17.2-1932)

The American Society for Testing Materials has been granted proprietary sponsorship to care for future revisions of these specifications. The A.S.T.M. designations are B 4-27 and B 5-27, respectively.

These standards, which are revisions of earlier A.S.T.M. specifications for copper wire bars, were developed by A.S.T.M. Committee B-2 on Non-Ferrous Metals and Alloys in order to harmonize minor differences in the provisions of available specifications covering these materials. Both standards are widely used, and are, in fact, generally recognized for all copper transactions in the United States. They are also used as a basis for practically all copper transactions abroad, through the use of French and German translations prepared by the Copper Exporters Association.

ASA Approves Standard for Wood Foundry Patterns

A new American Recommended Practice for Foundry Patterns of Wood (B45.1-1932) has been approved by the American Standards Association. The standard was submitted to ASA by the American Foundrymen's Association, which had an important part in its development, and which offered to be sponsor for the standard, or joint sponsor with the American Society of Mechanical Engineers if the A.S.M.E. so desired. Since this suggestion was approved by the A.S.M.E., the two organizations have been appointed joint sponsors, and as the two bodies are also joint sponsors for the project on Foundry Equipment and Supplies (B45), future revisions of the new standard are expected to be handled by the sectional committee on this subject.

The standard color markings provide the molder with correct information regarding location of cores, the surfaces to be machined, the portions to be filled where stop-off construction is used; and also insure preparation of the mold in the proper manner.

The new standard was developed by a committee consisting of two members each of the American Foundrymen's Association, the American Society for Testing Materials, the Steel Founders' Society of

America, the National Association of Pattern Manufacturers, and the American Institute of Mining and Metallurgical Engineers. The Subcommittee on Color Markings for Patterns developed tentative standards which in 1926 were submitted for approval to the several organizations concerned, and were later approved by the entire committee and published. Several thousands of copies have been issued by the American Foundrymen's Association. The standard was approved in 1930 at a Commercial Standard (CS 19) by the National Bureau of Standards and reprinted without change in 1932.

The pamphlet may be purchased from the American Standards Association at 10 cents per copy.

Conference on Inch-Millimeter Conversion for Industrial Use

A general conference under the auspices of the American Standards Association will be held in New York on October 21 to give American industry an opportunity to discuss a request made by the Ford Motor Company to ASA that the value 25.4 be adopted as the American Standard ratio between the inch and the millimeter in so far as industrial measurements are concerned.

In the United States the official ratio between the inch and the millimeter is based on the relationship between the meter and the inch as laid down by law in 1866; namely, one meter equals 39.37 inches. This gives the following approximate relationship between the inch and the millimeter: 1 inch equals 25.40005 mm. The difference between this figure and the value 25.4, only two parts in one million, is negligible in all cases except those where the highest accuracy of measurement is required. It is of a smaller order of magnitude than the degree of accuracy required even in manufacturing industries working with the greatest precision in the sizing of parts. For this reason it has been common practice for years to use the ratio 25.4 in manufacturing. However, different figures, such as the official ratio 25.40005 and the rounded figure 25.4001 are also given, for example, in engineering handbooks, with consequent dissimilarity in the conversion tables based on these respective figures.

In Great Britain, where the official ratio also differs from the figures 25.4, industry has already approved a national standard (No. 350-1930, published by the British Standards Institution) based on the ratio 25.4 and giving corresponding conversion tables. It seems probable that if the same ratio is adopted for practical use by American industry, this figure will become a world standard and all confusion arising from variety in conversion practice will be removed.

A special committee of seven members was appointed in the spring by the chairman of the ASA Standards Council to make a recommendation to the Standards Council in regard to the request submitted by the Ford Motor Company. This committee is made up of the following members: C. B. Veal, Society of Automotive Engineers, *chairman*; H. W. Bearce, Bureau of Standards; L. F. Adams, National Electrical Manufacturers' Association; F. O. Hoagland, National Machine Tool Builders' Association; C. E. Johansson, gage manufacturer; C. B. LePage, American Society of Mechanical Engineers; and Paul V. Miller, Gage Manufacturers' Association. The unanimous recommendation of this committee was that the request should be dealt with under ASA procedure and that a decision might well be taken by the General Acceptance Method (this usually hinges around a general conference), the organization of a sectional committee not being necessary.

The decision of this conference will be an important one, particularly to all manufacturing industries that use limit gaging practice. While the answer to the Ford Motor Company's request depends mainly on the approval of the ratio 25.4, matters of secondary importance can probably also be easily decided in principle at the conference, such as the general set-up of the conversion tables based on this ratio, which probably will be deemed necessary for practical purposes.

Principles of Work for Committee on Tolerances

An outline of the fundamental principles which should govern the activities of the working committee of the Sectional Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4) has been sent by R. E. W. Harrison, chairman of the working committee, to its members and unanimously approved by them.

Mr. Harrison's letter, which will be of interest to all who are concerned with the formulation of standards, is, in part, as follows:

"(*a*) All the members of our working committee have had a number of years experience in an executive capacity, hence it is hardly necessary to say that this experience, which to some of us has probably been extremely bitter in its absorption, has taught us that it is utterly futile to recommend a system or to issue instructions which cannot reasonably be adhered to. Hence it is my thought that when our recom-

mendations are eventually submitted, that they should be characterized by their utter simplicity of presentation.

"(*b*) The people who will have to put these recommendations into actual operation will be practical men, handling reamers and gages and pieces of work, not on paper, but in actuality, and our recommendations should be characterized also by absolute practicability endorsed by the reamer manufacturers, the gage manufacturers, the tool supervisors, production engineers and inspectors, who will have to interpret them.

"(*c*) While theoretical considerations cannot under any circumstances be ignored, they must not be injected into the recommendations if they, in any way, interfere with the practicability of the scheme.

"(*d*) Some systems which have been evolved in the past have been based on the assumption that it is possible to buy reamers, drills, and machine tools, which will produce work of absolute accuracy, irrespective of the ratio of length to diameter. No greater fallacy exists. Everything which is manufactured is made with some sort of a tolerance, and this applies even to the standard meter which is kept under a glass case at the Bureau of Standards at Washington. Hence, as I see it, our recommendations must be tempered by a full account of this knowledge of the tolerances inseparable from the instruments which will have to be used to produce the scheme of fits which this subcommittee puts forward.

"(*e*) We must reach agreement even, I believe, before our first meeting, as to how far we are going to permit our recommendations to be influenced by foreign practices. While it would be foolish in the extreme to ignore the accumulated experience of foreign countries, the writer believes that we must lay down as a basic principle that these recommendations are for American industry, are suited to American methods of manufacture, and are only influenced in those phases where the experience of foreign engineers can be utilized in the furtherance of the American scheme of manufacturing.

"(*f*) The writer believes that it is essential to the success of the efforts of this subcommittee that we have the wholehearted support of the technical press and with your approval, therefore, providing that this approval is unanimous would propose to engage the active cooperation of the editors of all the leading technical journals."

Why Not Standards?

An engineer at the Road Show remarked that there are more than 2,000 different kinds, types, and sizes of grader blades on the market, and about 1,000 different drag plates. What a burden of replacement to strap on the backs of already burdened municipalities and contractors! It would seem easy for the engineers of the road machinery companies to get together and convince their executives that standards would be better in the long run than the old ideas of individuality in order to sell replacement parts.—*Reprinted from "Product Engineering," April, 1932.*

Standard Grading Rules for Face Brick

Standard grading rules to be used as a basis for the sale of face brick were adopted by the American Face Brick Association at its last annual meeting, according to *Wood Construction*.

"Face brick has joined the growing list of building materials which are being sold under grading rules that protect both the buyer and the seller," an article in the February issue of the publication stated. "Four classifications are given in the rules, namely, uniform shade, mingled shade, substandard, and cull. All first quality brick are placed in the first two classifications, which have stringent requirements as to dimensional variations, chippage, color and warpage.

"The rules as adopted are based upon the standardized sizes of brick which were established in 1923. At the time a size of 8 x 3⅞ x 2¼ inches was made standard for smooth face brick, while a size of 8 x 3¾ x 2¼ inches was made standard for rough-textured face brick. It was recognized then, as now, that it is impossible to manufacture brick conforming exactly to these sizes, but no limitations as to the variation in sizes were worked out. The new rules cover this point thoroughly."

Simplified Practice Recommendation on Grinding Wheels

A revision of the Simplified Practice Recommendation covering grinding wheels became effective on October 1, according to an announcement from the Division of Simplified Practice of the National Bureau of Standards.

New wheel sizes necessary to meet the current needs of the consumer were added in this revision, the third since the recommendation was formulated and developed by the industry in 1925.